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Breast Cancer Screening for African American Women

Jennifer Ross
University of Kentucky

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Jennifer Ross, Student

Robin Vanderpool, DrPH, CHES, Committee Chair

Linda Alexander, EdD, Director of Graduate Studies

The Effect of Race and Socioeconomic Factors on Breast Cancer Screening Disparities: An Unweighted Analysis of 2012 CDC BRFSS Data

CAPSTONE PROJECT PAPER

A capstone submitted in partial fulfillment
of the requirements for the
Degree of Masters of Public Health
in Health Behavior

By
Jennifer Ross

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Capstone Committee
Robin Vanderpool, DrPH, CHES, Chair
Corrine Williams, ScD, Committee Member
Richard Crosby, PhD, Committee Member

BIOGRAPHICAL SKETCH

This capstone was completed by Jennifer Ross. In preparation for graduate school, Jennifer attended Northern Kentucky University, where she received a Bachelor's of Arts in Biological Sciences. She is provisionally certified in public health (CPH) by the National Board of Public Health Examiners. She will gain full certification upon completion of her Master of Public Health degree from the University of Kentucky in 2015. If you would like to contact her please use the following information:

Address: 1459 Arlington Drive
Florence, KY, 41042
Email: rossjenn08@gmail.com

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ABSTRACT

INTRO Breast cancer is the most common type of malignancy among women in the United States (U.S.) and the second leading killer. Despite the availability of effective breast screening tools, a disparity has formed. Specifically, white women over the age of 40 experienced a higher incidence rate of breast cancer, while African American women experience higher related mortality rate. The purpose of this study was to examine SES and ethnicity/race factors that may influence breast cancer screening rates, and specifically explore how those factors may differ between African American and white women.

METHODS Women between the ages of 50-74 who have never been told that they had cancer were asked a series of questions related to breast cancer screening behavior. They were also asked about their race/ethnicity, and SES. Combined, education level, employment status, annual income, and insurance coverage act as proxy measures for SES. Bivariate analysis using chi-square tests and binary logistic regression were used to determine factors associated with screening behaviors.

RESULTS The majority of the sample were white (78%) and African American (11%). A higher percentage of African Americans were up to date with receiving a mammogram within the past 2 years at every educational level, employment status, and income level, compared to white females. Using binary logistic regression, African American women had twice the odds of receiving a mammogram than white women.

DISCUSSION With SES proving to have minimal association with factors influencing mammography behavior, intervention programs should focus on other factors that may be influencing breast cancer mortality rates in African American women. Increasing the recommendation for breast cancer screening from biennially to annually could potentially allow the disease to be detected sooner and be treated.

INTRODUCTION

Breast cancer is the most common type of malignancy among women in the United States (U.S.) and the second leading cause of cancer-related mortality. [1,2,3] In 2015, the estimated number of new cases of female breast cancer will reach 231,840, with an estimated 40,290 related deaths. [4] Over the course of a lifetime, 1 in 8 women will be diagnosed with breast cancer and an estimated 85% of breast cancer cases will occur among women who have no family history of the disease. [2]

To date, mammography screening is the most effective technique for the early detection of breast cancer. This medical procedure can detect breast cancer before it becomes invasive. [5] As a result of the increased adoption of mammography screening among women in the U.S. between 1980 and 1987, breast cancer incidence rates increased rapidly among women of all races. Over time, however, from 1987 to 2002, breast cancer incidence stabilized again. Despite the availability of an effective screening tool, a disparity in breast cancer mortality for minority populations began to appear. [6,7,8] Specifically, white women over the age of 40 experienced a higher incidence rate of breast cancer, while African American women experienced higher related mortality rate. [2,6,7]

One potential explanation for increased breast cancer mortality, decreased survival, and elevated rates of later stage disease among African American women relates to historically low rates of timely breast cancer screening among this population. [6,7] Specifically, prior research suggested African Americans were more likely to receive inadequate health care through poor quality mammography screenings, fail to receive a screening recommendation and appropriate follow-up from health care providers, and overall, less utilization of mammography. [6,9,11] Indeed,

research in this area has identified race/ethnicity as a primary contributor to the differences in breast cancer outcomes. [10,11]

Interestingly, however, over the past decade there has been an increase in breast cancer screening rates among African American women compared to white women. [6,12,13] Specifically, there is a higher prevalence of mammography screening among African American women aged 40 years or older (64%) compared to white females (59%). [13] Regardless of historical or current time periods, it is evident not all women receive screening according to recommended guidelines, thereby failing to benefit from the advantages of mammography screening for reducing breast cancer mortality. [6,15]

Arguments have also been made that socioeconomic status (SES), not race/ethnicity alone, is the cause of the breast cancer disparities found in African American women. [16,17] The belief is that low SES perpetuates inaccurate knowledge and beliefs concerning the cause of breast cancer and the availability of preventive screening measures. [18] Additional research suggests that low SES results in a reduced social environment, decreased education levels, lack of quality health insurance, and reduced employment opportunities. [19] Researchers have suggested that all of these factors, which are associated with lower SES, have prevented African American women from receiving adequate routine mammography screening, and has led to higher mortality rates. [20,21,22]

The purpose of this study was to examine SES and ethnicity/race factors that may influence breast cancer screening rates, and specifically explore how those factors may differ between African American and white women. It is anticipated that there will be a significant association solely between race/ethnicity and breast cancer screening (Figure 1) after adjusting

for socioeconomic status, providing justification for investigating other factors that may be contributing to breast cancer mortality rates in African American women.

DATA COLLECTION

Data was collected from the Centers for Disease Control and Prevention (CDC) 2012 Behavioral Risk Factor Surveillance System (BRFSS). This data collection program was designed to measure behavioral risk factors among adults 18 years of age and older, living in households, through the collection of surveillance data obtained via monthly landline and cellular telephone interviews. [23] A disproportionate stratified sample (DSS) design was used to randomly select numbers for dialing, in order to identify an ideal sample population. In 2012, all 50 states and territories included core component questions regarding preventive cancer screenings, including mammography utilization, and individual's socio-demographic information. Computer-Assisted Telephone Interviewing (CATI) systems were used for data collection. Trained state health workers and contractors conducted the interviews, and the core portion of the questionnaire lasted an average of 18 minutes. Of the responses from the BRFSS questionnaire, 49.1% were from landline phones and 35.3% were from cellular phones. [23] The response rates for landline and cell phone samples had a median of 45.2%, the maximum was 60.4% and the minimum was 27.7%. Because the data is de-identified and publically available, this study did not require Institutional Review Board (IRB) review according to the University of Kentucky Office of Research Integrity.

MEASURES

Women between the ages of 50-74 who have never been told that they had cancer were the target population for this study. Women were asked a series of questions related to breast

cancer screening; queries were specifically related to mammography screening and clinical breast exams. Mammography is the best screening tool available for breast cancer detection, followed by a clinical breast exam conducted by a trained health care professional. The U.S. Preventive Services Task Force recommends women over age 50 receive a mammogram and clinical breast exam (CBE) every 2 years[3]. There were two questions about mammography behavior: 1) "Have you ever had a mammogram?" (yes/no), and if they answered "yes" to the first question, they would continue to the second question, 2) "How long has it been since you had your last mammogram?" (within the past year/within the past 2 years/within the past 3 years/within the past 5 years/5 or more years ago/don't know). Women were also asked two questions about CBE: 1) "Have you ever had a clinical breast exam?" (yes/no), and if they answered "yes" to the first question, they would continue to the second question, 2) "How long has it been since your last breast exam?" (within the past year/within the past 2 year/within the past 3 years/within the past 5 years/5 or more years ago/don't know).

The independent variables included in this study are race/ethnicity, and SES. Combined, education level, employment status, annual income, and insurance coverage act as proxy measures for SES. Women were asked two questions concerning their race/ethnicity: 1) "Are you Hispanic or Latino?" (yes/no), and 2) "Which of these groups would you say best represents your race?" (White/Black or African American/Asian/Native Hawaiian or Other Pacific Islander/American Indian or Alaska Native/Other). Women were also asked their highest level of education completed (did not graduate High School/graduated High School/attended College or Technical School/graduated from College or Technical School). Regarding employment, women were asked to choose a response from the following response options: employed for wages, self-employed, out of work for more than 1 year, out of work for less than 1 year, homemaker,

student, retired, and unable to work. Concerning income, women were asked their annual household income from all sources: ≤ $10,000/ ≤ $15,000/ ≤ $20,000/ ≤ $25,000 /≤ $35,000/ ≤$50,000/ ≤ $75,000/ $75,000+. To measure health insurance coverage, women were asked: "Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, government plans such as Medicare, or Indian Health Service?" (yes/no).

STATISTICAL ANALYSES

Initial unweighted analyses examined the socio-demographic characteristics of the sample population. Bivariate analysis using chi-square tests assessed the proportion of women receiving breast cancer screening by race/ethnicity (white vs. African American only), and SES (education level, employment status, income level, and health insurance coverage). Because income level is an ordinal variable, the Gamma statistic also was reported. Binary logistic regression was used to determine factors associated with receipt of mammography screening only. Missing data, including "don't know/unsure" responses, were excluded from the analysis. All analyses were conducted using SPSS version 22.0.

RESULTS

The primary study sample participants consisted of women aged 50 to 74 who have never been diagnosed with any type of cancer (N=113,395); their socio-demographic and breast cancer screening profile are shown in Table 1. The mean age was 61 years (SD=6.9); the majority of the sample was white (78%) followed by African American (11%) and Hispanic (6%). Approximately, one-third of participants reported graduating from college or technical school (32%), and more than half earned >$35,000 annually (56%). Almost two out of every five women were employed for wages (38%) and a vast majority had some form of health insurance

coverage (91%). An overwhelming majority of the women (95%) reported ever having a mammogram, and 94% reported ever having a CBE. The majority of women reported having a mammogram (82%) or CBE (80%) within the past 2 years (Table 1).

African American women (96%) and white women (95%) had similar percentages for ever having a mammogram. Although the chi-square result was statistically significant (X^2 = 16.725, p<.001), the extremely small effect size (Phi = -.013) indicates that this significance may be due to the large sample size. White females (95.1%) were more likely than African American females (90%) to report ever having a CBE. These results were statistically significant (X^2 = 489.78, p<.001) with a larger effect size (Phi = 0.71) indicating that the significance is not impacted by the size of the sample (Table 2).

The proportion of women receiving a mammogram and CBE within the past 2 years were similar within each race category. However, African American women (83%) were more likely to receive a mammogram within the past 2 years than white women (77%). With a statistically significant chi-square (X^2 = 184.033, p<.001), and a very small effect size (Phi = 0.044). African American women (78%) were also just as likely to receive CBE as white women (76%). The chi-square results are statistically significant (X^2 = 23.105, p<.001), and had an extremely small effect size (Phi = 0.016). These small effect sizes indicates that the significance may be due to the size of the sample (Table 3).

Stratified analyses were conducted to compare African American females to white females across the different socioeconomic factors identified in this study. The comparisons were for mammography usage only and excluded CBE. As expected, the percentages for both race/ethnicity groups being up-to-date with mammography screenings increased as income level increased. A higher percentage of African Americans were up to date with receiving a

mammogram within the past 2 years at every educational level, employment status, and income level, compared to white females. The small effect sizes from the chi-square analyses may indicate that the significance may be due to the size of the sample.

The chi-square results for African American women being up-to-date with mammography screening at different income levels was statistically significant ($X^2 = 201.250$, $p<.001$) with a small effect size (Gamma = 0.250). White women being up-to-date with mammography screening was also statistically significant ($X^2 = 2846.745$, $p<.001$) with a small effect size (Gamma = 0.303) (Table 4).

Concerning educational level, African Americans being were up-to-date with mammography screening was statistically significant ($X^2 = 1127.599$, $p<.001$) with an extremely small effect size (Phi = 0.096). White women being up-to-date with mammography screening was statistically significant ($X^2 = 103.940$, $p<.001$) with a small effect size (Phi = 0.115) (Table 5).

Among African American women receiving a mammogram within the past 2 years, the highest rates were observed among those who were retired (87%) or employed for wages (85%), and for whites who were retired (81%) or employed for wages (79%). The lowest percentages for both African American (73%) and white (61%) women were those out of work $\geq$ 1 year. The results for African American women was statistically significant ($X^2 = 136.749$, $p<.001$) with a small effect size (Phi = 0.110). White women had statistically significant results ($X^2 = 1254.064$, $p<.001$) with a small effect size (Phi = 0.122) (Table 6).

Not surprisingly, a greater percentage of women with insurance coverage received a mammogram than those without coverage. African American women, whether having health

insurance or not, had a higher percentage of receiving a mammogram within the past 2 years compared to white women. Though the chi-square results are statistically significant (X^2 = 433.099, p<.001), the small effect size (Phi = -0.196) indicates that this significance may be due to the size of the sample population. White females had statistically significant results (X^2 = 4380.536, p<.001) with a small effect size (Phi = -0.227) (Table 7).

A binary logistic regression was created to determine factors associated with receipt of mammography screening. Controlling for educational level, health insurance, employment status, and income, African American women had twice the odds of receiving a mammogram than white women (OR=2.26, 95%CI 2.13, 2.40) (Table 8).

DISCUSSION

The reported use of breast cancer screening (mammography and CBE) among African American females and white females aged 50 – 74 years in the U.S. was compared and analyzed. A greater percentage of African American women were up-to-date with receiving a mammogram within the past 2 years at every educational level, employment status, health insurance status and income level, compared to white females. Among women earning less than $20,000 annually, a greater proportion of African American women compared to white women were up-to-date with their mammography screenings. Also, among women who did not graduate from high school, more African American women were up-to-date with mammography screening, compared to white women. These results are unexpected, considering previous research has indicated that African American females who have lower income and education levels experience lower rates of breast cancer screening compared to white females. [17,21,22] Newer literature has pointed to

uninsured African American women being more likely to receive mammography screening than uninsured white women, which is evident in this study. [14]

African American women had twice the odds of being up-to-date on mammography screening than white women even when controlling for educational level, health insurance, employment status, and income, which act as proxy for SES. This is consistent with newer research, pointing to the increased proportion of African American women receiving mammography screening over the past decade compared to white women. [12,4] The main cause of this increase in mammography screening in African American women remains unknown. [24]

Inconsistent with known literature, [12,14] however, was the fact that white women in this study population being more likely to receive CBE than African American women. These higher proportion of CBE for white females suggests that white women may be having more conversations with their health care providers regarding breast cancer screening options compared to African American women.

A strength of this study is that the 2012 Behavioral Risk Factor Surveillance System (BRFSS) is a nationally conducted survey, designed methodically by the CDC, to provide a glimpse of the health conditions of the U.S. population through a large sample size. Another strength was that the questions concerning breast cancer screening behavior and SES demographics were asked to participants in all 50 states and territories, reaching a large population. Although the design of the BRFSS is a strength, because data are self-reported there may be influences of recall bias and social desirability bias. Recent evidence suggests that self-report surveys are likely to overestimate mammography utilization. [16] The sample size is another limitation, resulting in multiple associations that are statistically significant, but perhaps not clinically or practically significant (i.e., Type 1 error).

The U.S. has seen a higher proportion of breast cancer screening rates among African American women from within the past decade. [6,12,14] Even though this increase was observed, disparities in breast cancer mortality for African American women still persists. With SES proving to have minimal association with factors influencing mammography behavior, intervention programs should focus on other factors that may be influencing breast cancer mortality rates in African American women such as obesity, poor diet, and decreased physical activity. [20] More research is also needed in discovering the cause of the increased rate of mammography screening, and how this will impact future mortality rates among African American women. [24] Increasing the recommendation for breast cancer screening for African American women from biennially to annually could potentially allow the disease to be detected sooner and be treated. [15] Considering African American women tend to be diagnosed with more advanced stages with more aggressive breast tumors, this recommendation may prove advantageous for this population.[6,7] Research has shown that African American women are more likely to receive inadequate health care access through poor quality mammography screenings, and lack of recommendation and follow-up from health care providers. [9,10,11] Next steps should be to examine these factors pinpointing what is causing the disparity in mortality to persist among African American populations.

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APPENDIX

Figure 1. Conceptual Model

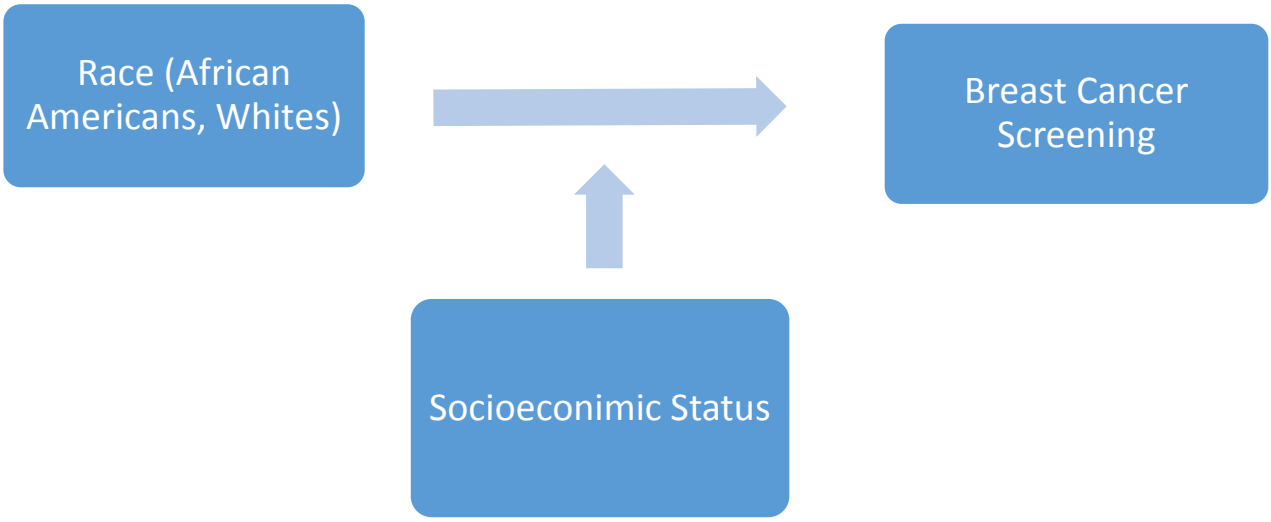

Table 1. Socio-demographic and breast cancer screening profiles of study sample N=113,395.

Demographics	**n (%)**
Female (age 50-74)	113,395 (100.0)
Age (mean, SD)	61 (6.9)
Race/ethnicity (n=112,266)	
White	87861 (78.3)
Black/African American	11927 (10.6)
Asian	1470 (1.3)
Hispanic	6908 (6.2)
Native Hawaiian/Pacific Islander	228 (.2)
American Indian or Alaskan Native	1565 (1.4)
Other	543 (0.5)
More than one race	1764 (1.6)
Education (n=113,028)	
Did not graduate High School	9580 (8.5)
Graduated High School	34832 (30.8)
Attended College or Technical School	31980 (28.3)
Graduated from College or Technical School	36636 (32.4)
Annual Income (n=96,482)	
Less than $10,000	6462 (6.7)
Less than $15,000 ($10,000 to < $15,000)	6720 (7.0)
Less than $20,000 ($15,000 to < $20,000)	8001 (8.3)
Less than $25,000 ($20,000 to < $25,000)	9564 (9.9)
Less than $35,000 ($25,000 to < $35,000)	11499 (11.9)
Less than $50,000 ($35,000 to < $50,000)	14566 (15.1)
Less than $75,000 ($50,000 to < $75,000)	15838 (16.4)
≥ $75,000	23832 (24.7)
Employment (n=112,902)	
Employed for wages	43255 (38.3)
Retired	34457 (30.5)
Unable to work	11872 (10.5)
A homemaker	9390 (8.3)
Self-employed	7962 (7.1)
Out of work >1 year	3527 (3.1)
Out of work < 1 year	2148 (1.9)
A student	291 (0.3)
Insurance Coverage (n=113,148)	
Yes	102580 (90.7)
No	10568 (9.3)
Breast Cancer Screenings	
Have you ever had a mammogram? (n=109862)	
Yes	104640 (95.2)
No	5222 (4.8)

How long has it been since you had your last mammogram? (n=103,889)	
Within the past year (anytime < 12 months)	67615 (65.1)
Within the past 2 years (1 year but < 2 years)	17210 (16.6)
Within the past 3 years (2 years but < 3 years)	6712 (6.5)
Within the past 5 years (3 years but < 5 years)	4717 (4.5)
5 or more years	7635 (7.3)
Have you ever had a clinical breast exam? (n=109,406)	
Yes	102378 (93.6)
No	7028 (6.4)
How long has it been since your last breast exam? (n=100,979)	
Within the past year (anytime <12 months)	65693 (65.1)
Within the past 2 years (1 year but <2 years)	15798 (15.6)
Within the past 3 years (2 years but <3 years)	6297 (6.2)
Within the past 5 years (3 years but <5 years)	4605 (4.6)
5 or more years	8586 (8.5)

Table 2. Proportion of African American women and white women ever receiving a mammogram or clinical breast exam.

	Ever had a mammogram?			Ever had a clinical breast exam?		
Race/ethnicity	Yes (n=92523)	No (n=4453)	X^2 p value	Yes (n=91320)	No (n=5300)	X^2 p value
African American	96.2%	3.8%	X^2 = 16.725	90.1%	9.9%	X^2 = 489.78
White	95.3%	4.7%	P < .001	95.1%	4.9%	P < .001

MAM: PHI = -0.013

CBE: PHI = 0.71

Table 3. Proportion of African American women and white women receiving a mammogram or clinical breast exam within the past 2 years or after 2 years.

	How long since had your last mammogram?			How long since last breast exam?		
Race/ethnicity	Within past 2 years (n=75197)	More than 2 years (n=21134)	X^2 p value	Within past 2 years (n=72758)	More than 2 years (n=22655)	X^2 p value
African American	83.0%	17.0%	X^2 = 184.033	78.1%	21.9%	X^2 = 23.105
White	77.4%	22.6%	P < .001	76.0%	24.0%	P < .001

MAM: PHI = 0.044

CBE: PHI = 0.016

Table 4. Proportion of African American women and white women who are or not up-to-date with mammography screening compared to annual income level.

	Received mammogram within the past 2 years? (African American)			Received mammogram within the past 2 years? (White)		
Annual Income	Yes (n=8186)	No (n=1657)	X^2 p value	Yes (n=56463)	No (n=16635)	X^2 p value
< $10,000	75.1%	24.9%		60.7%	39.3%	
$10,000 - $15,000	77.7%	22.3%		61.5%	38.5%	
$15,000 - $20,000	79.7%	20.3%	X^2 = 201.205	64.9%	35.1%	X^2 = 2846.75
$20,000 - $25,000	82.8%	17.2%		69.1%	30.9%	
$25,000 - $35,000	84.6%	15.4%	P < .001	74.0%	26.0%	P < .001
$35,000 - $50,000	86.6%	13.4%		78.7%	21.3%	
$50,000 - $75,000	90.2%	9.8%		82.1%	17.9%	
≥ $75,000	91.3%	8.7%		85.8%	14.2%	

MAM white: Gamma = 0.303

MAM black: Gamma = 0.250

Table 5. Proportion of African American women and white women who are or not up-to-date with mammography screening compared to education level.

	Received mammogram within the past 2 years? (African American)			Received mammogram within the past 2 years? (White)		
Education Level	Yes (n=9364)	No (n=1918)	X^2 p value	Yes (n=65727)	No (n=19192)	X^2 p value
Did not graduate High School	77.0%	23.0%	X^2 = 1127.599 P < .001	64.4%	35.6%	X^2 = 103.940 P < .001
Graduated High School	81.1%	18.9%		74.2%	25.8%	
Attended College or Technical School	84.6%	15.4%		76.4%	23.6%	
Graduated from College or Technical School	87.9%	12.1%		83.0%	17.0%	

MAM white: Phi = 0.115

MAM black: Phi = 0.096

Table 6. Proportion of African American women and white women who are or not up-to-date with mammography screening compared to employment status

	Received mammogram within the past 2 years? (African American)			Received mammogram within the past 2 years? (White)		
Employment Status	Yes (n=9362)	No (n=1915)	X^2 p value	Yes (n=65683)	No (n=19163)	X^2 p value
Employed for wages	84.6%	15.4%		79.4%	20.6%	
Self-employed	74.6%	25.4%		71.1%	28.9%	
Out of work >1 year	72.5%	27.5%	X2 = 136.749	60.6%	39.4%	X^2 = 1254.064
Out of work < 1 year	75.4%	24.6%	P < .001	70.3%	29.7%	P < .001
A homemaker	77.8%	22.2%		75.4%	24.6%	
A student	80.0%	20.0%		66.5%	33.5%	
Retired	86.9%	13.1%		81.4%	18.6%	
Unable to work	80.0%	20.0%		68.1%	31.9%	

MAM white: Phi = 0.122

MAM black: Phi = 0.110

Table 7. Proportion of African American women and white women who are or not up-to-date with mammography screening compared to having or not having health insurance coverage.

	Received mammogram within the past 2 years? (African American)			Received mammogram within the past 2 years? (White)		
Insurance Coverage	Yes (n=9367)	No (n=1911)	X^2 p value	Yes (n=65713)	No (n=19166)	X^2 p value
Yes	86.2%	13.8%	X^2 = 433.099	80.2%	19.8%	X^2 = 4380.536
No	65.9%	34.1%	P < .001	44.4%	55.6%	P < .001

MAM white: Phi = -0.227

MAM black: Phi = -0.196

Table 8. Logistic regression for African American women controlling for education, employment, annual income, and health insurance coverage.

Demographics	Odds Ratio	95% Confidence Interval	
		Lower	Upper
African American (Race/ethnicity)	2.258	2.126	2.398
Education	1.072	1.056	1.087
Health Insurance	0.288	0.273	0.304
Employment Status	1.037	1.030	1.043
Income Level	1.187	1.176	1.198
R^2 = 0.100			